



TURMOIL

IPSEC VPN

SESSIONIZATION

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REVISION HISTORY

Issue	Date	Author	Amendments
0.1	8/15/08	ET	First draft of document

REFERENCE DOCUMENTS

- 1.

1.0 (U) SCOPE

This document describes the sessionization requirements for the various IPsec VPN protocols processed in Turmoil. The list of IPsec protocol stacks of interest is shown here:

- IP/ESP
- IP/AH/ESP
- IP/UDP/ISAKMP
- IP/UDP/nulls/ISAKMP
- IP/TCP/ISAKMP
- IP/TCP/nulls/ISAKMP

Currently, IP/ESP, IP/UDP, and IP/TCP are successfully sessionized by the FIP. Other IPsec stacks have been observed in the field, and we have requirements to process them in Turmoil. For completeness, all of the stacks are discussed in this document, even though some are currently being processed.

2.0 (S) ESP SESSIONIZATION

2.1 (S) IP/ESP

2.1.1 (S) DETECTION

The AEG loads the FSPF with the following keyword and mask pair for this protocol:

keyword: 45 FF FF FF FF FF FF FF FF 32 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF F5
mask: FF 00 00 00 00 00 00 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0F

This indicates that the packets that satisfy the following parameters will be selected by this keyword for processing in the ESP_AEG:

- IPv4 packet
- IP Header Length = 5
- IP Next Protocol = ESP (0x32)
- ESP Sequence Number = 5

The ESP Sequence Number requirement implements a "sampling" function on the ESP, reducing the ESP traffic by a factor of 1/16, to limit the ESP loading in the AEG.

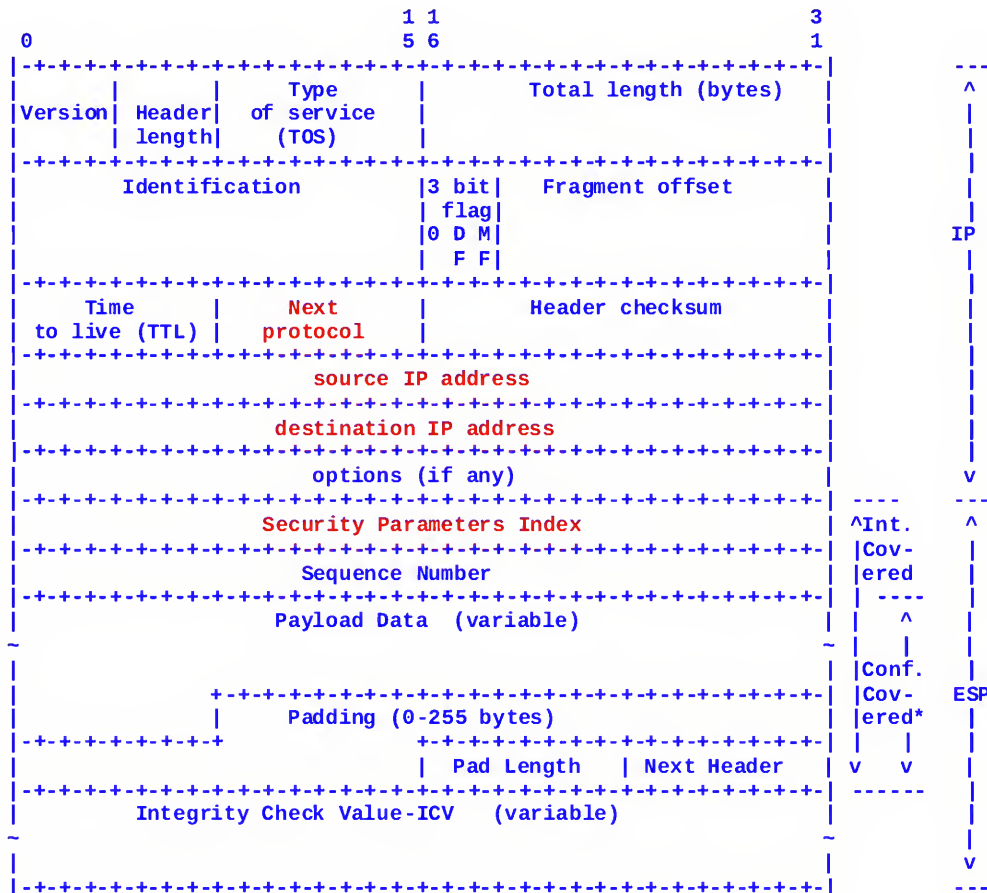
2.1.2 (S) SESSIONIZING

The ESP packets would be sessionized by the following set of parameters:

- IP Next Protocol = 50 (0x32)
- IP Source Address
- IP Destination Address
- ESP Spi

2.1.3 (S) THE STACK

The fields utilized in sessionization are highlighted in red in the diagram below:



2.2 (S) IP/AH/ESP

2.2.1 (S) DETECTION

The AEG loads the FSPF with the following keyword and mask pair for this protocol:

```
keyword: 45 FF FF FF FF FF FF FF FF 33 FF FF FF FF FF FF FF FF 32 FF FF FF FF FF FF FF FF
FF FF F5
mask: FF 00 00 00 00 00 00 00 00 FF 00 00 00 00 00 00 00 00 00 FF 00 00 00 00 00 00 00
00 00 0F
```

This indicates that the packets that satisfy the following parameters will be selected by this keyword for processing in the ESP_AEG:

- IPv4 packet
- IP Header Length = 5
- IP Next Protocol = AH (0x33)
- AH Next Payload = ESP (0x32)
- ESP Sequence Number = 5

2.2.2 (S) SESSIONIZING

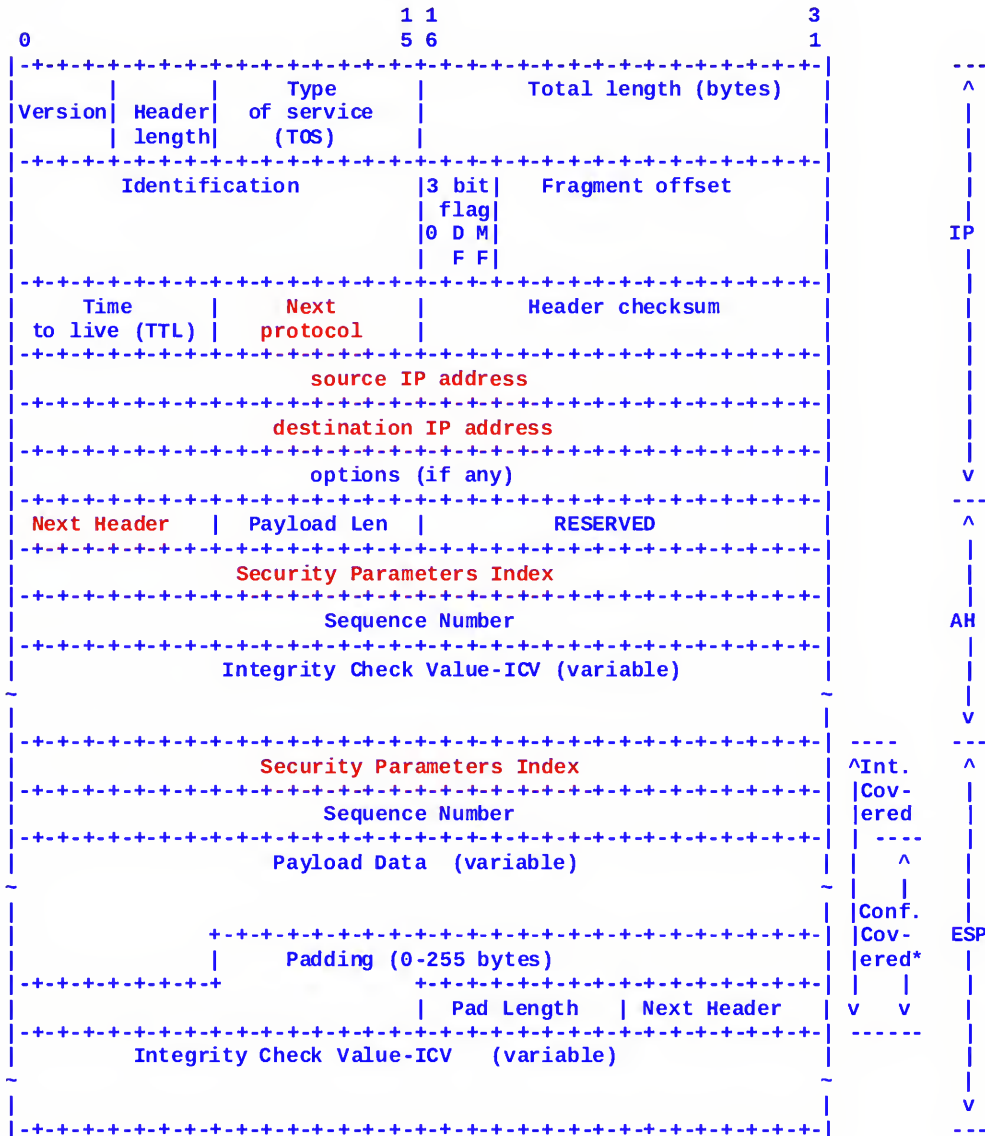
The AH/ESP packets would be sessionized by the following set of parameters:

- IP Next Protocol = 51 (0x33)
- IP Source Address
- IP Destination Address
- AH Next Payload = 50 (0x32)
- AH Spi
- ESP Spi

The software FSPF is currently programmed to recognize only TCP, UDP, and ESP as valid Network Layers. However, since our AH/ESP keywords start at the Network (IP) Layer, those packets will make it through the FSPF to the AEG. [REDACTED] said that the change to the FSPF to recognize AH at the Transport Layer would be easy to implement.

The DFCE does not currently recognize AH as a valid Transport Layer, and that change will apparently be difficult to implement. The new idea is to develop "application-specific demux" components for the TE, that will perform any desired sessionization based on parameters after the Network (IP) Layer.

2.2.3 (S) THE STACK



3.0 (S) IKE SESSIONIZATION

3.1 (U) IP/UDP/ISAKMP

3.1.1 (S) DETECTION

The AEG loads the FSPF with the following keyword and mask pair for this protocol:

```
keyword: 45 FF FF FF FF FF FF FF FF 11 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
mask: FF 00 00 00 00 00 00 00 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 60 FF D8 F8 00 00 00 00 FF FF
```

This indicates that the packets that satisfy the following parameters will be selected by this keyword for processing in the IKE_AEG:

- IPv4 packet
- IP Header Length = 5
- IP Next Protocol = UDP (0x11)
- ISAKMP Version = 0x10
- ISAKMP Next Payload, Exchange Type, and Flags fields all have ranges of valid values
- ISAKMP Length (header + payload) < 64k

We have a similar keyword/mask pair for ISAKMP Version 9.9.

3.1.2 (S) SESSIONIZING

The UDP/ISAKMP packets would be sessionized by the following set of parameters:

- IP Next Protocol = UDP (0x11)
- IP Source Address
- IP Destination Address
- UDP Source Port
- UDP Destination Port

- IPv4 packet
- IP Header Length = 5
- IP Next Protocol = UDP (0x11)
- 4 bytes of NULLS between the UDP and ISAKMP layers
- ISAKMP Version = 0x10
- ISAKMP Next Payload, Exchange Type, and Flags fields all have ranges of valid values
- ISAKMP Length (header + payload) < 64k

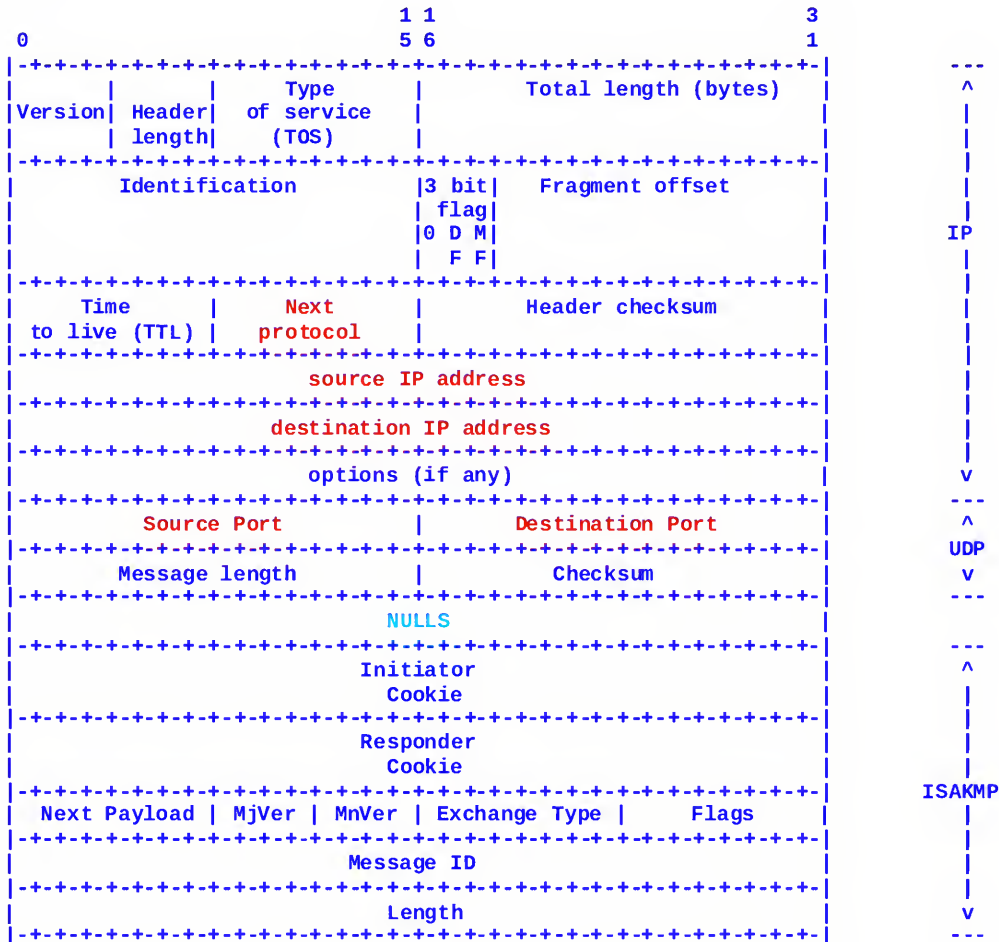
We have a similar keyword/mask pair for ISAKMP Version 9.9.

3.2.2 (S) SESSIONIZING

The UDP/nulls/ISAKMP packets would be sessionized by the following set of parameters:

- IP Next Protocol = UDP (0x11)
- IP Source Address
- IP Destination Address
- UDP Source Port
- UDP Destination Port

3.2.3 (U) THE STACK



3.3 (U) IP/TCP/ISAKMP

3.3.1 (S) DETECTION

The AEG loads the FSPF with the following keyword and mask pair for this protocol:

```
keyword: 45 FF FF FF FF FF FF FF FF 06 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF 00 00
mask: FF 00 00 00 00 00 00 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 FF FF
```

This indicates that the packets that satisfy the following parameters will be selected by this keyword for processing in the IKE_AEG:

- IPv4 packet
- IP Header Length = 5
- IP Next Protocol = TCP (0x06)
- ISAKMP Version = 0x10
- ISAKMP Next Payload, Exchange Type, and Flags fields all have ranges of valid values
- ISAKMP Length (header + payload) < 64k

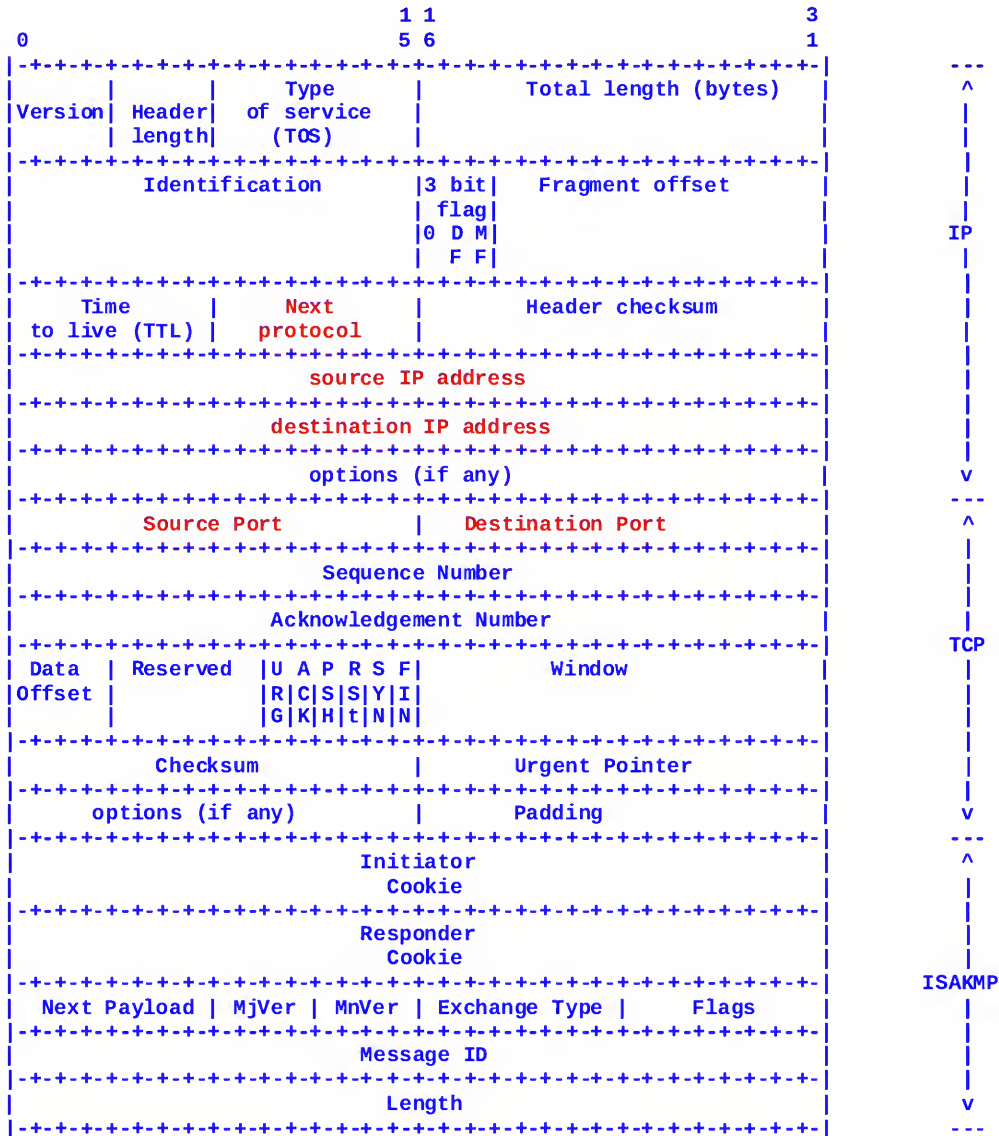
We have a similar keyword/mask pair for ISAKMP Version 9.9.

3.3.2 (S) SESSIONIZING

The TCP/ISAKMP packets would be sessionized by the following set of parameters:

- IP Next Protocol = TCP (0x06)
- IP Source Address
- IP Destination Address
- TCP Source Port
- TCP Destination Port

3.3.3 (S) THE STACK



3.4 (U) IP/TCP/NULLS/ISAKMP

3.4.1 (S) DETECTION

The AEG loads the FSPF with the following keyword and mask pair for this protocol:

keyword: 45 FF FF FF FF FF FF FF FF FF 06 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
 FF FF FF FF FF FF FF FF FF FF FF FF 00 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF 00
 10 00 00 FF FF FF FF 00 00
mask: FF 00 00 00 00 00 00 00 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 00 00 00 00 00 00 00 00 00 00 00 00 FF FF FF FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 FF D8 F8 00 00 00 00 FF FF

This indicates that the packets that satisfy the following parameters will be selected by this keyword for processing in the IKE_AEG:

- IPv4 packet
- IP Header Length = 5
- IP Next Protocol = TCP (0x06)
- 4 bytes of NULLS between the TCP and ISAKMP layers
- ISAKMP Version = 0x10
- ISAKMP Next Payload, Exchange Type, and Flags fields all have ranges of valid values
- ISAKMP Length (header + payload) < 64k

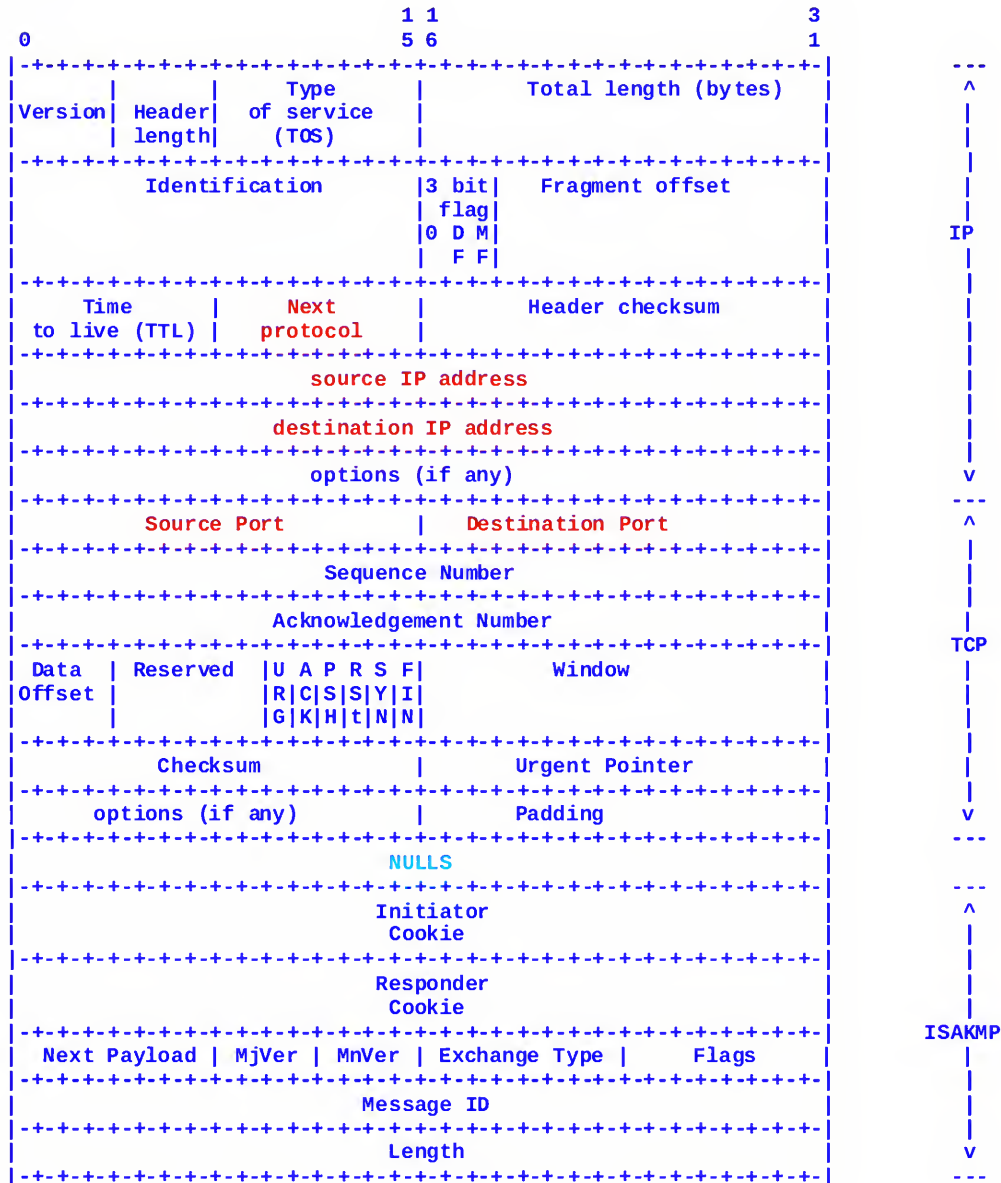
We have a similar keyword/mask pair for ISAKMP Version 9.9.

3.4.2 (S) SESSIONIZING

The TCP/nulls/ISAKMP packets would be sessionized by the following set of parameters:

- IP Next Protocol = TCP (0x06)
- IP Source Address
- IP Destination Address
- TCP Source Port
- TCP Destination Port

3.4.3 (S) THE STACK



4.0 (U) SUMMARY

The FIP currently recognizes UDP, TCP, and ESP as valid Network Layer protocols, and currently sessionizes those packet types. The new requirement for IP/AH/ESP will require changes to the FIP to recognize AH as a valid layer, and will also require changes to the DFCE to allow those packets through.

There has been talk of having application-specific demuxes developed and inserted into the TE to perform any required sessionization beyond the Transport Layer. For example, the ESP demux would be responsible for sessionizing on Spi value.

The Table below summarizes the various protocol stacks, the parts of the stacks that are used in PPF keyword detection, and how the associated packets should be sessionized.

Protocol Stack	Keyword Detection Layers	Sessionization Requirements
IP/ESP	IP, ESP	IP Next Protocol = 50 IP Source Address IP Destination Address ESP Spi
IP/AH/ESP	IP, AH, ESP	IP Next Protocol = 51 IP Source Address IP Destination Address AH Next Header = 50 AH Spi ESP Spi
IP/UDP/ISAKMP * we have separate keywords for ISAKMP Versions 1.0 and 9.9	IP, UDP, ISAKMP	IP Next Protocol = 17 IP Source Address IP Destination Address UDP Source Port UDP Destination Port
IP/UDP/nulls/ISAKMP * we have separate keywords for ISAKMP Versions 1.0 and 9.9	IP, UDP, ISAKMP	IP Next Protocol = 17 IP Source Address IP Destination Address UDP Source Port UDP Destination Port

IP/TCP/ISAKMP * we have separate keywords for ISAKMP Versions 1.0 and 9.9	IP, TCP, ISAKMP	IP Next Protocol = 6 IP Source Address IP Destination Address TCP Source Port TCP Destination Port
IP/TCP/nulIs/ISAKMP * we have separate keywords for ISAKMP Versions 1.0 and 9.9	IP, TCP, ISAKMP	IP Next Protocol = 6 IP Source Address IP Destination Address TCP Source Port TCP Destination Port